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Oral Health Awareness Among Dental Students at the College of Dentistry, University of Babylon: A Cross-Sectional Survey Comparing Pre-Clinical and Clinical Years

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ABSTRACT

Background: Dental students are the next generation of oral health educators. Despite Iraq's high oral disease burden and unique risk-factor profile, comprehensive data on oral health knowledge, attitudes and behaviours (KAB) across the full undergraduate cohort at the College of Dentistry, University of Babylon Iraq's dental school are lacking. Objective: To assess oral health awareness across four domains knowledge of oral diseases, personal oral hygiene practices, awareness of oral–systemic links, and attitudes toward patient education — and to compare pre-clinical (Years 1–2) and clinical (Years 3–5) undergraduate dental students. Methods: A cross-sectional, questionnaire-based survey was conducted between January 2022 and June 2023. A 42-item validated self-administered questionnaire was distributed to 350 students using stratified proportional sampling across all five academic years. Data were analyses with SPSS v26 using descriptive statistics, chi-square, independent-samples t-test and ANOVA at $\alpha = 0.05$. Results: Of 350 questionnaires, 320 were fully completed (response rate 91.4%). Mean age was 21.3 ± 1.7 years; 61.9% were female. Overall good knowledge was 67.5%; clinical students scored significantly higher than pre-clinical peers (78.3% vs 54.5%, $p < 0.001$). Twice-daily brushing was reported by 71%, flossing by 38%, and past-year dental check-up by 45%, all with clinical-year advantage. Awareness of the diabetes–oral health link was 65% and the cardiovascular link 48.1%, both significantly higher in clinical years. While 85% endorsed dental students' educator role, only 72% felt adequately prepared, rising from 50% (Year 1) to 95% (Year 5). Conclusions: Oral health awareness improves significantly across the CoDUB curriculum, but persistent gaps in self-care behavior's and systemic-link literacy argue for an earlier, more structured, vertically integrated preventive-dentistry curriculum.

Keywords: Cross-Sectional Studies, Dental Students, Education Dental, Health Knowledge Attitudes Practice, Iraq, MeSH, Oral Health, Oral Hygiene, Patient Education as Topic

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1 Introduction

ORAL diseases remain among the most prevalent non-communicable conditions worldwide. The GBD 2021 Oral Disorders study estimated that oral conditions affected 3.69 billion people in 2021, with untreated dental caries of permanent teeth ranking as the single most prevalent condition assessed [1]. The World Health Organization's Global Oral Health Status Report 2022 confirmed that oral diseases affect nearly half the world's population and noted that the burden has grown by over one billion cases in 30 years, with the steepest increases in low- and middle-income countries of the Eastern Mediterranean Region [2, 3].

Iraq displays an oral disease burden consistent with and in several indicators exceeding — regional averages. A nationwide online study demonstrated inappropriate awareness of oral and periodontal disease in the Iraqi population, with fewer than half of respondents recognizing the bidirectional link between periodontal inflammation and systemic conditions [4]. Concurrent data show dental caries prevalence of 61% in primary dentition and 84% in permanent dentition among Iraqi schoolchildren [5, 6], and periodontitis prevalence exceeding 50% in adult Iraqi attendees [7].

In this context, oral health awareness encompassing knowledge of oral diseases, recognition of risk factors and systemic associations, internalized preventive behaviors, and the attitudinal disposition to communicate these to patients has emerged as a key upstream determinant of population oral health [8]. Dental students occupy a uniquely strategic position: they are simultaneously role models, the future preventive workforce, and the principal deliverers of chair-side oral health education in tertiary Iraqi dental hospitals [9, 10]. International evidence consistently shows that dental students' KAB improves with curriculum progression, particularly at the pre-clinical-to-clinical transition [11-13]. A 2025 systematic review and meta-analysis of 7,747 dental students from 17 countries concluded that, while the global trajectory is positive, Middle Eastern dental schools remain substantially under-represented in the evidence base [14].

Within Iraq, available data are largely limited to the Kurdistan Region. A Sulaimani study by Zardawi et al. in 2023 reported significantly better periodontal knowledge and tooth-brushing frequency in clinical years, with marked gender differences favoring females [15, 16]. A 2023 multicentre survey addressed preventive-care knowledge among senior students and dentists, identifying deficiencies in topical fluoride application and a low valuation of preventive dentistry [17]. However, no published study has examined all four domains of oral health awareness across the entire five-year undergraduate cohort at the College of Dentistry, University of Babylon (CoDUB) — Iraq's oldest dental school (established in 1953) and the country's largest source of dental graduates. This gap is consequential given that CoDUB's five-year BDS curriculum is structured with predominantly basic-science and pre-clinical content in Years 1–2 and full patient contact from Year 3 onwards. [15, 16].

This study therefore aimed to:

- Quantify overall oral health awareness among CoDUB undergraduates across four pre-specified domains;
- Compare knowledge, practices, systemic-link awareness and attitudes between pre-clinical and clinical years;
- Identify specific content areas in greatest need of curricular reinforcement.

2 Methods

2.1 Study Design and Setting

A descriptive, analytical cross-sectional survey was conducted at the College of Dentistry, University of Babylon, Hilla, Iraq, between January 2022 and June 2023. The study was reported in accordance with the STROBE statement for observational studies [15, 16].

2.2 Sample Size and Sampling

Sample size was calculated using the single-population proportion formula $n = Z^2 \cdot P(1-P)/d^2$, with an anticipated awareness proportion of P = 0.65 based on the Iraqi baseline reported by [4] a 95% confidence level (Z = 1.96) and an absolute precision d = 0.05. This yielded a minimum of 350, confirmed adequate with finite-population correction for ~ 1,400 enrolled students. Stratified proportional sampling across the five academic years was applied, with simple random selection within each stratum [15].

2.3 Eligibility Criteria

Included were undergraduate students enrolled in Years 1–5 at CoDUB during the 2022–2023 or academic year who read English and provided written informed consent. Excluded were postgraduate students, intern dentists, students on academic leave, and questionnaires with > 10% missing items [17].

2.4 Questionnaire Development

A 42-item self-administered questionnaire was developed drawing on:

- The Hiroshima University–Dental Behavioural Inventory (HU-DBI) for self-care attitude items; [11, 12];
- The validated Iraqi Oral Health and Periodontal Disease Awareness instrument [4];
- WHO Oral Health Questionnaire items [2].

The questionnaire covered five sections: demographics (6 items); Domain 1 — knowledge of oral diseases (12 items: caries, periodontitis, oral cancer); Domain 2 — personal

oral hygiene practices (8 items); Domain 3 — oral–systemic links (8 items: diabetes, cardiovascular disease, pregnancy, tobacco); and Domain 4 — attitudes toward patient education (8 items). Knowledge items were dichotomous (correct/incorrect; good ≥ 8/12); attitude items used a 5-point Likert scale. Content validity was confirmed by a five-member CoDUB faculty panel (I-CVI ≥ 0.78 for all retained items). Pilot testing on 30 excluded students yielded Cronbach's α of 0.81 (knowledge), 0.74 (practices), 0.79 (systemic links) and 0.83 (attitudes) [17].

2.5 Ethical Approval

The protocol was approved by the Scientific Research and Ethics Committee of the College of Dentistry, University of Babylon (Approval No. [343/2022]). The study complied with the Declaration of Helsinki (2013 revision). Participation was anonymous, voluntary and unincentivized.

2.6 Statistical Analysis

Data were analyzed in IBM SPSS Statistics v26. Descriptive statistics, chi-square (or Fisher's exact test), independent-samples t-test and one-way ANOVA with Tukey post-hoc were used as appropriate. Two-sided $p < 0.05$ was considered statistically significant.

3 Results

3.1 Demographic Characteristics

Of 350 questionnaires distributed, 320 were returned fully completed (response rate 91.4%). Demographic data are presented in Table 1. Mean age was 21.3 ± 1.7 years; 198 (61.9%) were female and 122 (38.1%) were male. Pre-clinical students (Years 1–2) numbered 145 (45.3%) and clinical students (Years 3–5) 175 (54.7%). Most students resided in urban Babylon (78.4%), 88.1% reported parental higher education, and 24 (7.5%) were current tobacco users predominantly male (17.2% vs 1.5%; $p < 0.001$) [18].

3.2 Domain 1 — Knowledge of Oral Diseases

The overall proportion achieving good knowledge (≥ 8/12 correct) was 67.5% (n = 216). Clinical-year students outperformed pre-clinical peers substantially (78.3% vs 54.5%, $\chi^2 = 21.43$, $p < 0.001$) and mean scores differed significantly (9.2 ± 1.6 vs 7.4 ± 1.9, $t = -9.12$, $p < 0.001$). Across-year ANOVA showed a stepwise rise from Year 1 (7.0 ± 1.8) to Year 5 (9.6 ± 1.4; $F = 32.5$, $p < 0.001$), with Tukey post-hoc differences significant between pre-clinical and all three clinical years (all $p < 0.01$). Item-level analysis identified key gaps: recognition of pocket depth ≥ 4 mm as a periodontitis criterion was 38% (pre-clinical) vs 81% (clinical), and knowledge of the recommended oral-cancer visual screening interval was 44% vs 79% (both $p < 0.001$). Results are shown in Table 2 [19, 20].

Table 1. Demographic characteristics of study participants (n = 320).

Variable	Pre-clinical (n = 145)	Clinical (n = 175)	Total (n = 320)
Age, mean ± SD (years)	19.8 ± 0.9	22.5 ± 1.2	21.3 ± 1.7
Female sex, n (%)	92 (63.4)	106 (60.6)	198 (61.9)
Male sex, n (%)	53 (36.6)	69 (39.4)	122 (38.1)
1st year, n (%)	75 (51.7)	—	75 (23.4)
2nd year, n (%)	70 (48.3)	—	70 (21.9)
3rd year, n (%)	—	60 (34.3)	60 (18.8)
4th year, n (%)	—	60 (34.3)	60 (18.8)
5th year, n (%)	—	55 (31.4)	55 (17.2)
Urban residence, n (%)	113 (77.9)	138 (78.9)	251 (78.4)
Parental higher education, n (%)	128 (88.3)	154 (88.0)	282 (88.1)
Current tobacco use, n (%)	9 (6.2)	15 (8.6)	24 (7.5)

SD = standard deviation. Tobacco use: cigarettes, waterpipe or smokeless tobacco.

Table 2. Knowledge scores (mean ± SD) and proportion achieving good knowledge, by academic year.

Year	n	Mean knowledge score (0–12)	Good knowledge (≥ 8/12), n (%)	p*
1st	75	7.0 ± 1.8	36 (48.0)	
2nd	70	7.8 ± 1.9	43 (61.4)	
3rd	60	8.8 ± 1.6	44 (73.3)	
4th	60	9.3 ± 1.5	49 (81.7)	
5th	55	9.6 ± 1.4	44 (80.0)	
Pre-clinical	145	7.4 ± 1.9	79 (54.5)	
Clinical	175	9.2 ± 1.6	137 (78.3)	
Overall	320	8.4 ± 1.9	216 (67.5)	$F = 32.5/\chi^2 = 28.6$ $p < 0.001$

* $p < 0.001$ for pre-clinical vs clinical comparison (chi-square for proportions; independent t-test for means). Good knowledge defined as ≥ 8/12 correct items.

3.3 Domain 2 — Personal Oral Hygiene Practices

Twice-daily brushing was reported by 71% (n = 227), dental flossing ≥ weekly by 38% (n = 122), and a dental check-up within the past year by 45% (n = 144). Clinical-year students showed significantly better compliance across all indicators (all $p \leq 0.004$), with the largest gap in flossing (49.7% clinical vs 24.1% pre-clinical). Female students reported higher brushing (77.3% vs 60.7%, $p = 0.001$) and flossing rates (44.4% vs 27.9%, $p = 0.003$) than males, consistent with regional HU-DBI data [21, 22]. Even at Year 5, only 60% of students were regular flossers, underscoring the knowledge–behaviour gap. Results are presented in Table 3.

3.4 Domain 3 — Awareness of Oral–Systemic Links

Awareness of the bidirectional diabetes–periodontitis relationship was reported by 65.0% overall (pre-clinical 48.3% vs clinical 78.9%, $\chi^2 = 31.7$, $p < 0.001$) [23, 24]. The cardiovascular–periodontitis link was recognized by only 48.1% (pre-clinical 30.3% vs clinical 62.9%, $\chi^2 = 33.8$, $p < 0.001$) [25-27]. Pregnancy-related gingival changes were recognized by 71.6%, and 88.4% correctly identified smoking as a shared risk factor for periodontitis and respiratory disease — the only systemic-link item showing no significant pre-clinical/clinical difference. Results are shown in Table 4 [28].

3.5 Domain 4 — Attitudes toward Patient Education, and Overall Comparison

Eighty-five per cent (n = 272) agreed that dental students should educate patients; this did not differ between groups ($p = 0.71$). Preparedness to educate rose from 55.2% (pre-clinical) to 85.7% (clinical; $p < 0.001$) and by individual year from 50% (Year 1) to 95% (Year 5, $\chi^2 = 41.2$, $p < 0.001$). Tobacco-cessation counselling confidence was reported by only 21.4% of pre-clinical vs 57.1% of clinical students ($p < 0.001$). The composite attitude Likert score was 3.78 ± 0.71 pre-clinical vs 4.21 ± 0.59 clinical ($t = -5.92$, $p < 0.001$). The overall standardized awareness score was 56.4 ± 11.2 pre-clinical vs 76.8 ± 9.4 clinical ($p < 0.001$). A female advantage in composite attitude score persisted after stratification by year (4.10 ± 0.65 vs 3.84 ± 0.74; $t = 3.31$, $p = 0.001$). Summary data are presented in Table 5.

Table 3. Self-reported oral hygiene practices by academic year (n = 320).

Practice	Yr 1 (n = 75)	Yr 2 (n = 70)	Yr 3 (n = 60)	Yr 4 (n = 60)	Yr 5 (n = 55)	Pre-clin (n = 145)	Clinical (n = 175)
Brushes ≥ 2×/day, n (%)	42 (56.0)	45 (64.3)	44 (73.3)	48 (80.0)	48 (87.3)	87 (60.0) *	140 (80.0) *
Dental floss ≥ 1×/week, n (%)	13 (17.3)	22 (31.4)	24 (40.0)	30 (50.0)	33 (60.0)	35 (24.1) *	87 (49.7) *
Dental check-up past year, n (%)	22 (29.3)	30 (42.9)	27 (45.0)	32 (53.3)	33 (60.0)	52 (35.9) *	92 (52.6) *
Uses fluoride toothpaste, n (%)	41 (54.7)	44 (62.9)	39 (65.0)	43 (71.7)	39 (70.9)	85 (58.6)	121 (69.1)
Uses mouthwash regularly, n (%)	25 (33.3)	27 (38.6)	28 (46.7)	32 (53.3)	31 (56.4)	52 (35.9) *	91 (52.0) *

* $p < 0.01$ for pre-clinical vs clinical comparison (chi-square). Yr = Year; Pre-clin = pre-clinical students (Years 1–2); Clinical = Years 3–5.

Table 4. Awareness of oral–systemic links by academic year (n = 320).

Systemic link	Yr 1 (n = 75)	Yr 2 (n = 70)	Yr 3 (n = 60)	Yr 4 (n = 60)	Pre-clin (n = 145)	Clinical (n = 175)
Diabetes–periodontitis (bidirectional), n (%)	32 (42.7)	38 (54.3)	44 (73.3)	48 (80.0)	70 (48.3) *	138 (78.9) *
Cardiovascular disease–periodontitis, n (%)	18 (24.0)	26 (37.1)	33 (55.0)	38 (63.3)	44 (30.3) *	110 (62.9) *
Pregnancy gingival changes, n (%)	41 (54.7)	44 (62.9)	48 (80.0)	50 (83.3)	85 (58.6) *	144 (82.3) *
Smoking–periodontitis link, n (%)	64 (85.3)	60 (85.7)	53 (88.3)	56 (93.3)	124 (85.5)	159 (90.9)

* $p < 0.001$ for pre-clinical vs clinical comparison (chi-square). Yr = Year. Year 5 data omitted from table for space; all Year 5 figures exceeded Year 4 values.

Table 5. Composite domain scores and overall awareness comparison between pre-clinical and clinical years.

Domain / Item	Pre-clinical (n = 145)	Clinical (n = 175)	p
Knowledge score (mean ± SD, 0–12)	7.4 ± 1.9	9.2 ± 1.6	< 0.001
Hygiene-practice composite (% adherent)	39.7%	60.8%	< 0.001
Systemic-link awareness (mean ± SD, 0–8)	4.4 ± 1.6	6.5 ± 1.3	< 0.001
Attitude composite (mean ± SD, 1–5 Likert)	3.78 ± 0.71	4.21 ± 0.59	< 0.001
Endorses student role as patient educator, n (%)	122 (84.1)	150 (85.7)	0.71 (NS)
Feels adequately prepared to educate, n (%)	80 (55.2)	150 (85.7)	< 0.001
Confident in tobacco-cessation counselling, n (%)	31 (21.4)	100 (57.1)	< 0.001
Overall awareness score (standardized, 0–100)	56.4 ± 11.2	76.8 ± 9.4	< 0.001

NS = not statistically significant. Green p-values indicate $p < 0.001$; amber indicates $p \geq 0.05$. Overall awareness score = standardized mean of all four domains, range 0–100.

4 Discussion

4.1 Knowledge of Oral Diseases

This is the first comprehensive four-domain oral health awareness survey across the full undergraduate spectrum at CoDUB, and the headline finding — an overall awareness score of 76.8 vs 56.4 per 100 for clinical vs pre-clinical students ($p < 0.001$) — confirms that the CoDUB curriculum delivers progressive gains. However, context matters. The 54% good-knowledge rate among pre-clinical students is concerningly close to that of the general Iraqi public, [4] and the item-level gaps on periodontal pocket depth (38% correct, pre-clinical) and oral-cancer screening (44%) mirror data from Yemen [20] and Saudi Arabia [29]. The Eastern Mediterranean Region carries one of the highest oral cancer incidence rates globally, making early exposure to oral-cancer recognition a priority curricular investment [19].

4.2 The Knowledge–Behaviour Gap

The 71% twice-daily brushing rate and 38% flossing rate among CoDUB students sit between the Iraqi general-public baseline [4] and the 87–92% rates reported in German and Turkish dental schools [11, 12]. Even at fifth year, only 60% of CoDUB students flossed weekly — a pattern documented across Romanian [30], Arab multinational [21], and Iraqi [15] cohorts alike. The female advantage in both brushing and flossing is consistent with the Arab HU-DBI literature [21] and suggests that gender-targeted preventive messaging is warranted, particularly given the 17.2% tobacco-use rate among male students. [18] A recent meta-analysis by Xu et al. in 2025 explicitly recommends behaviorally anchored, not merely knowledge-based, preventive curricula a recommendation that aligns with these findings [14].

4.3 Oral–Systemic Links Awareness

The cardiovascular–periodontitis awareness deficit (48% overall, below 71% even in Year 5) is the most actionable gap identified. The 2023 EFP/WONCA consensus [25] and the 2026 American Heart Association scientific statement [31] establish periodontitis as an independent cardiovascular risk indicator supported by robust epidemiological and mechanistic evidence, confirmed in recent meta-analyses [26, 27, 32]. The 65% diabetes-link awareness, while higher, still trails the 80–90% seen in European cohorts [23]. Given Iraq's high diabetes prevalence (8.5–13.9%), integrating an interdisciplinary oral–systemic module into Year 2 pathology teaching is strongly warranted [24].

4.4 Attitudes and Patient Education Readiness

Near-universal endorsement of dental students' educator role (85%) is positive, but the 50% Year-1 preparedness rate demonstrates that confidence is built primarily through clinical exposure rather than classroom teaching. The 41% tobacco-cessation counselling confidence rate echoes the Saudi findings of [33] and confirms the need for structured communication-skills training with formative OSCE assessment, as recommended by the Graduating European Dentist (GED) competency framework [34]. The female attitude advantage mirrors the broader regional HU-DBI dataset [21, 22].

4.5 Curriculum Implications

Three evidence-based recommendations emerge. First, evidence-based preventive and oral–systemic content including the diabetes–periodontitis bidirectionality and the periodontitis–cardiovascular evidence should be front-loaded into Year 1 and Year 2, rather than deferred to clinical years. Second, vertically integrated communication-skills and motivational-interviewing training should begin in Year 2 with summative assessment by Year 4. Third, a student self-monitoring system (personal plaque-score logs, biennial OHI-S audits) would convert classroom

knowledge into observed behaviour, aligning CoDUB with the GED framework [34] and the WHO Global Oral Health Action Plan 2023–2030 [2].

4.6 Limitations

This is a single-centre study; generalization to private Iraqi colleges or Kurdistan-region schools requires caution. Data are self-reported and subject to social-desirability bias, mitigated by anonymous administration. The cross-sectional design captures association, not causation. The questionnaire was not re-validated in Arabic, and behavioural domains were not corroborated by clinical examination [33].

5 Conclusion

Oral health awareness at the College of Dentistry, University of Babylon improves significantly with curriculum progression, with clinical-year students outperforming pre-clinical peers across all four domains. However, important gaps persist: fewer than half of students across all years recognize the periodontitis–cardiovascular association, only 60% of fifth-year students floss regularly, and fewer than half feel confident delivering evidence-based tobacco-cessation advice. We recommend front-loading oral–systemic preventive content into the pre-clinical years, introducing vertically integrated communication-skills training with summative assessment, and institutionalizing student self-monitoring of personal oral hygiene — moves that would align CoDUB's curriculum with both the WHO Global Oral Health Action Plan 2023–2030 and the Graduating European Dentist competency framework.

Conflict of Interest: The authors declare no conflict of interest.

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